CO_2 Capture Project

CO2 Capture: Baseline Costs for Four Real-Life Scenarios

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Agenda

- CCP Program
- The Four Scenarios
- Best Available Technology
- Jargon
- Economics
- Results
- What's Next ?

CCP Public/Private Collaboration

bp · ChevronTexaco · EnCana · Eni · Hydro · Shell · Statoil · Suncor

US Department of Energy

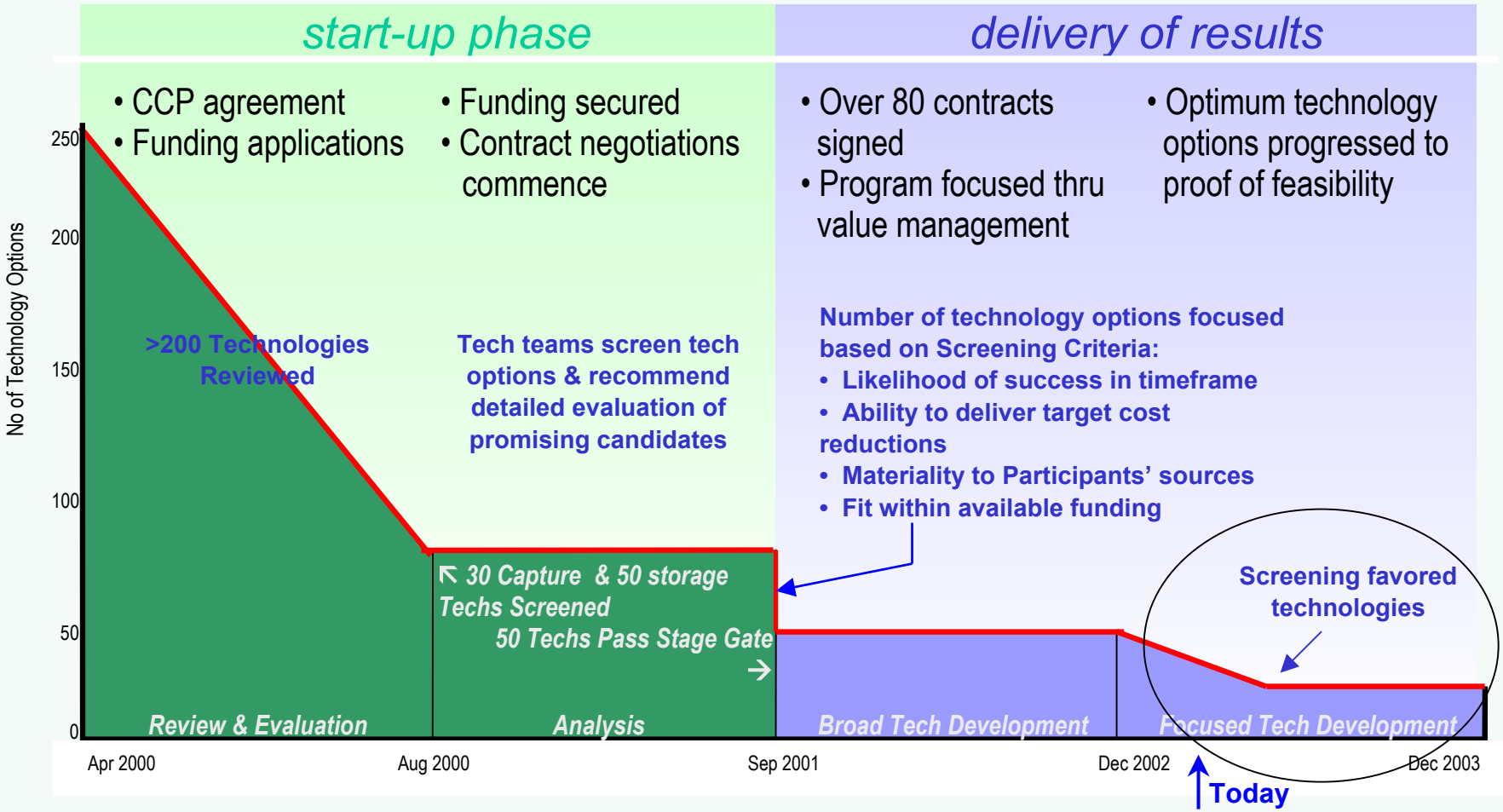
European Union

Klimatek NorCap

CCP Goals: Capture Technology

- By the end of 2003
- For each Scenario (of 4), at least one technology has been developed, which (when compared to today's baseline) will:
  a. Reduce the cost of Capture & Storage
     i. By 50% for retrofit
     ii. By 75% for newbuild

CCP Timeline



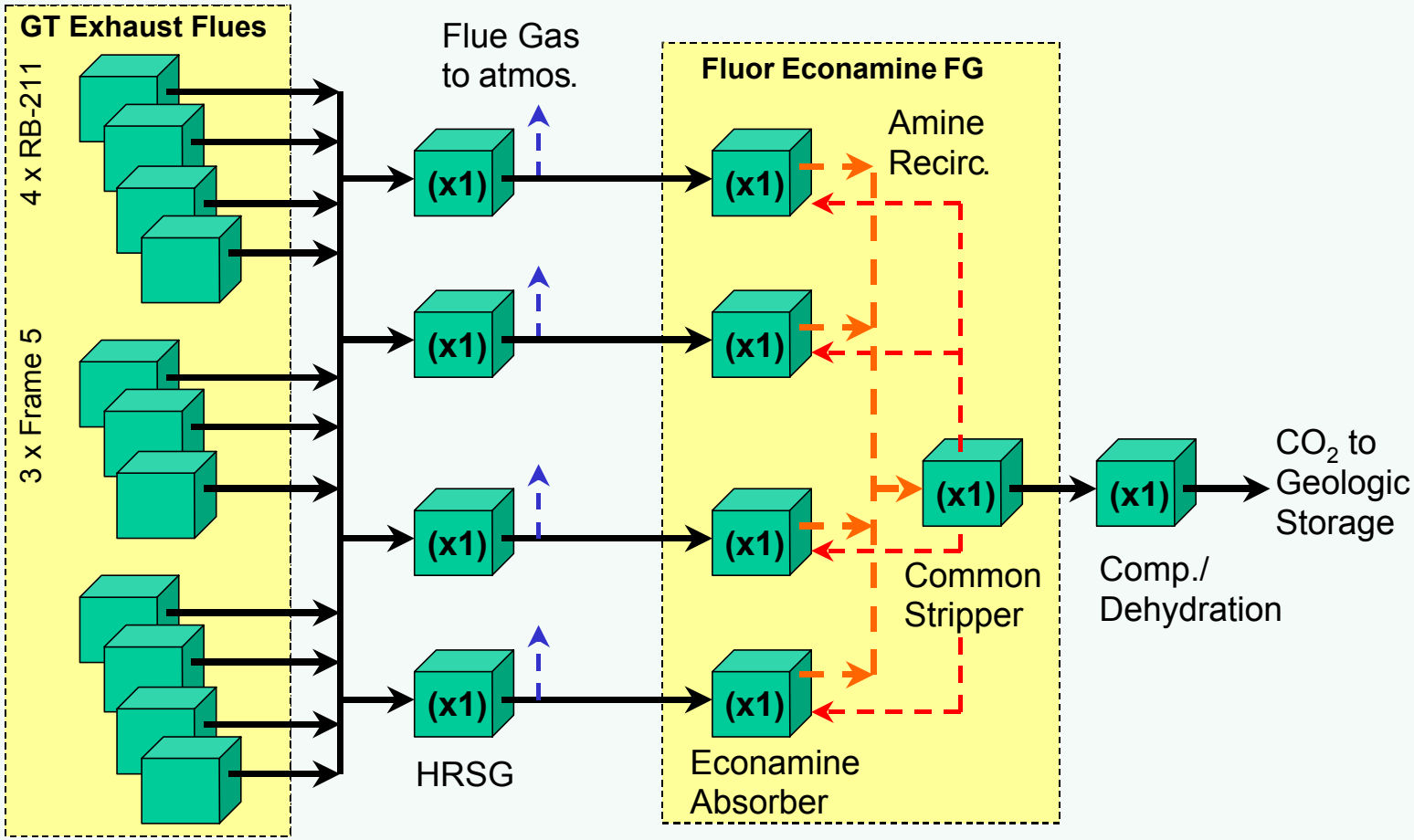
Why Scenarios ?

- Diverse, Real-life Situations
- Establish Baseline (uncontrolled emissions)
- Control with Today's Best Available Technology
- Technology Development
- Choose the Best New Technology
- Benchmark Improvement
    a. on a like-for-like basis

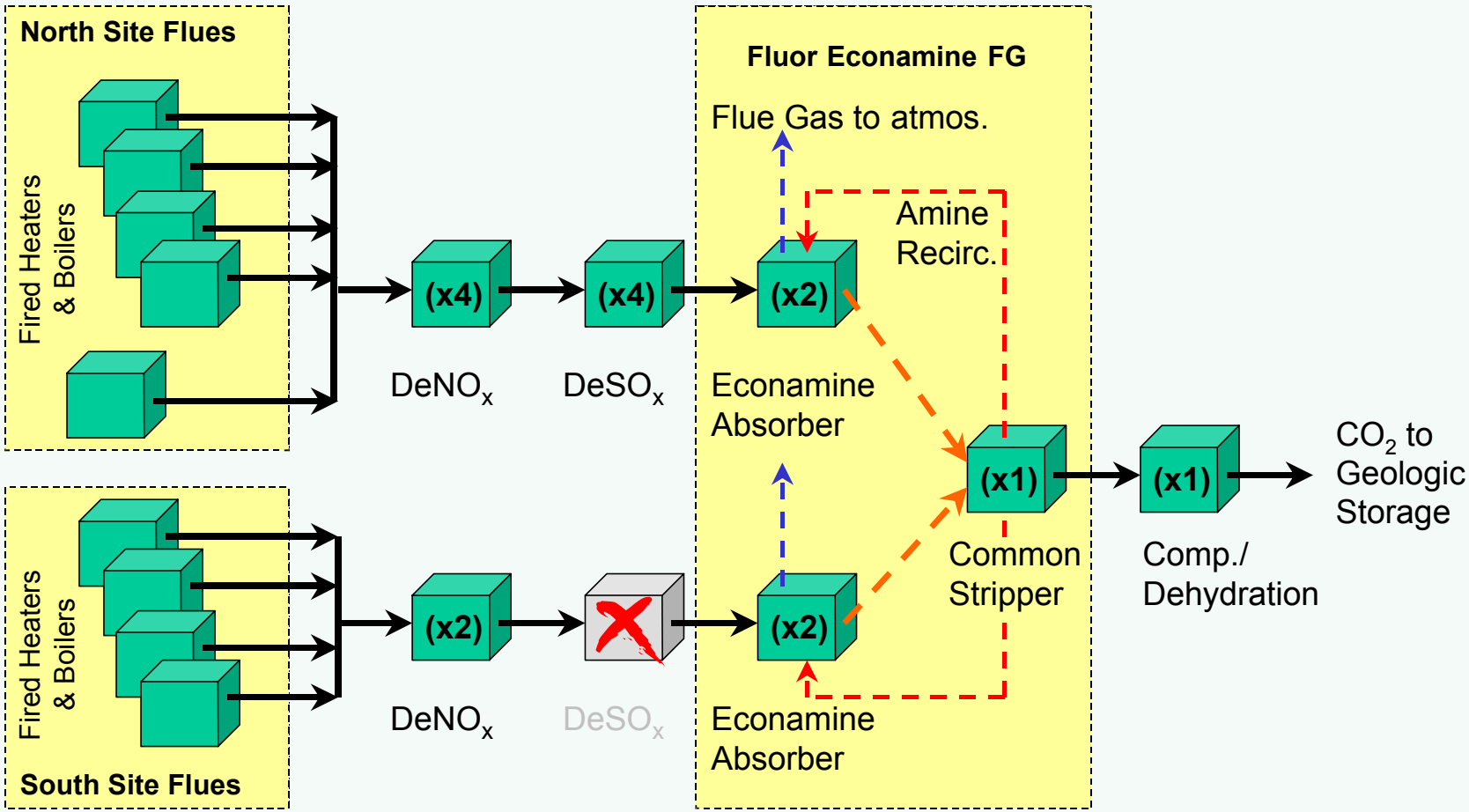
The Four Scenarios

Scenario	Location	Fuel Source	Retrofit/ Newbuild	Uncontrolled Emission (mmtpa CO2)	CO2 Content (%)
Distributed Gas Turbines	Alaska, USA	Natural Gas	Retrofit	2.1	3%
Refinery	UK, Europe	Natural Gas & Liquids	Retrofit	4.0	8%
Large Gas Turbines	Norway	Natural Gas	Newbuild	1.2	5%
Petroleum Coke Gasification	Canada	Coke	Newbuild	7.4	10.5%

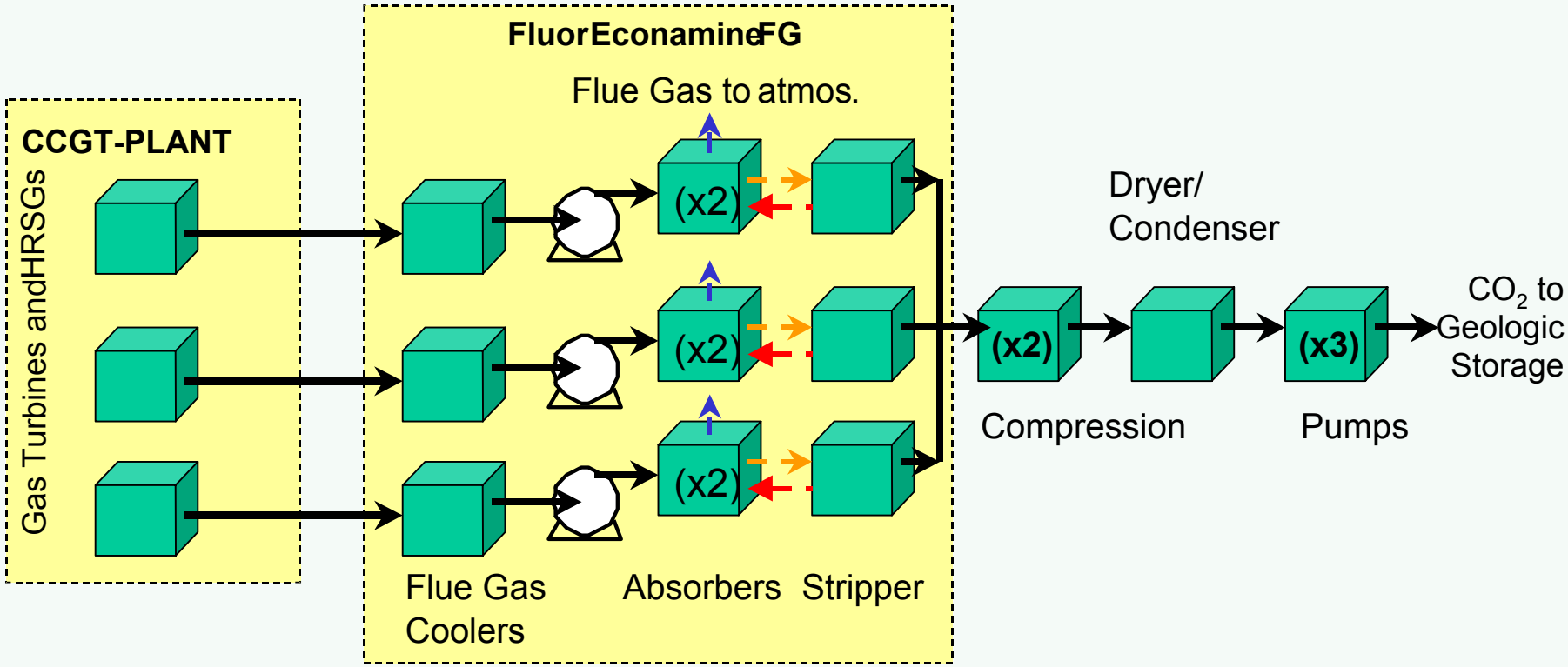
Distributed Gas Turbines (Alaska USA)



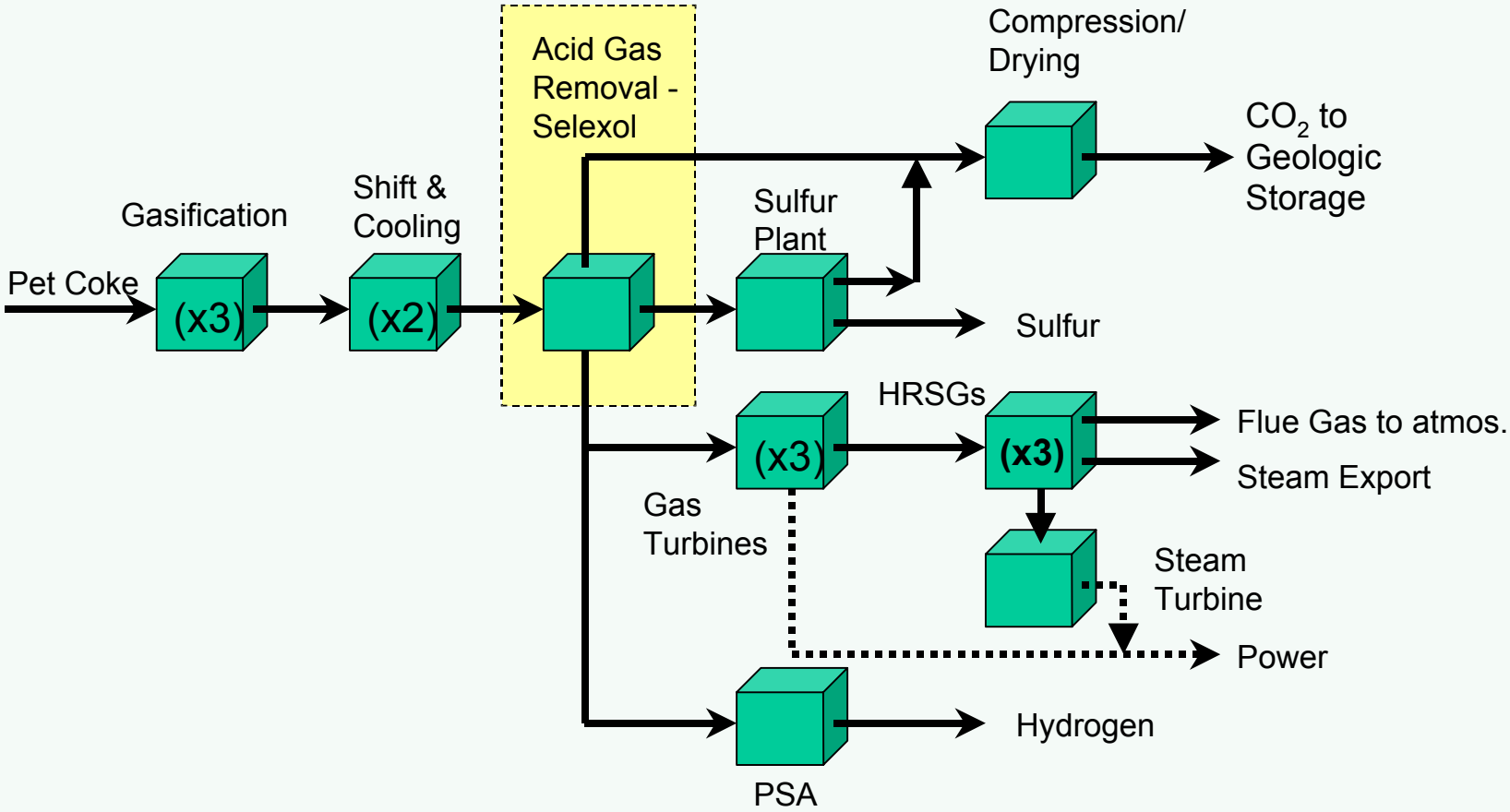
Refinery (Grangemouth, UK Europe)



Very Large Turbines (Norway)



Petroleum Coke Gasification (Canada)



Best Available Technology

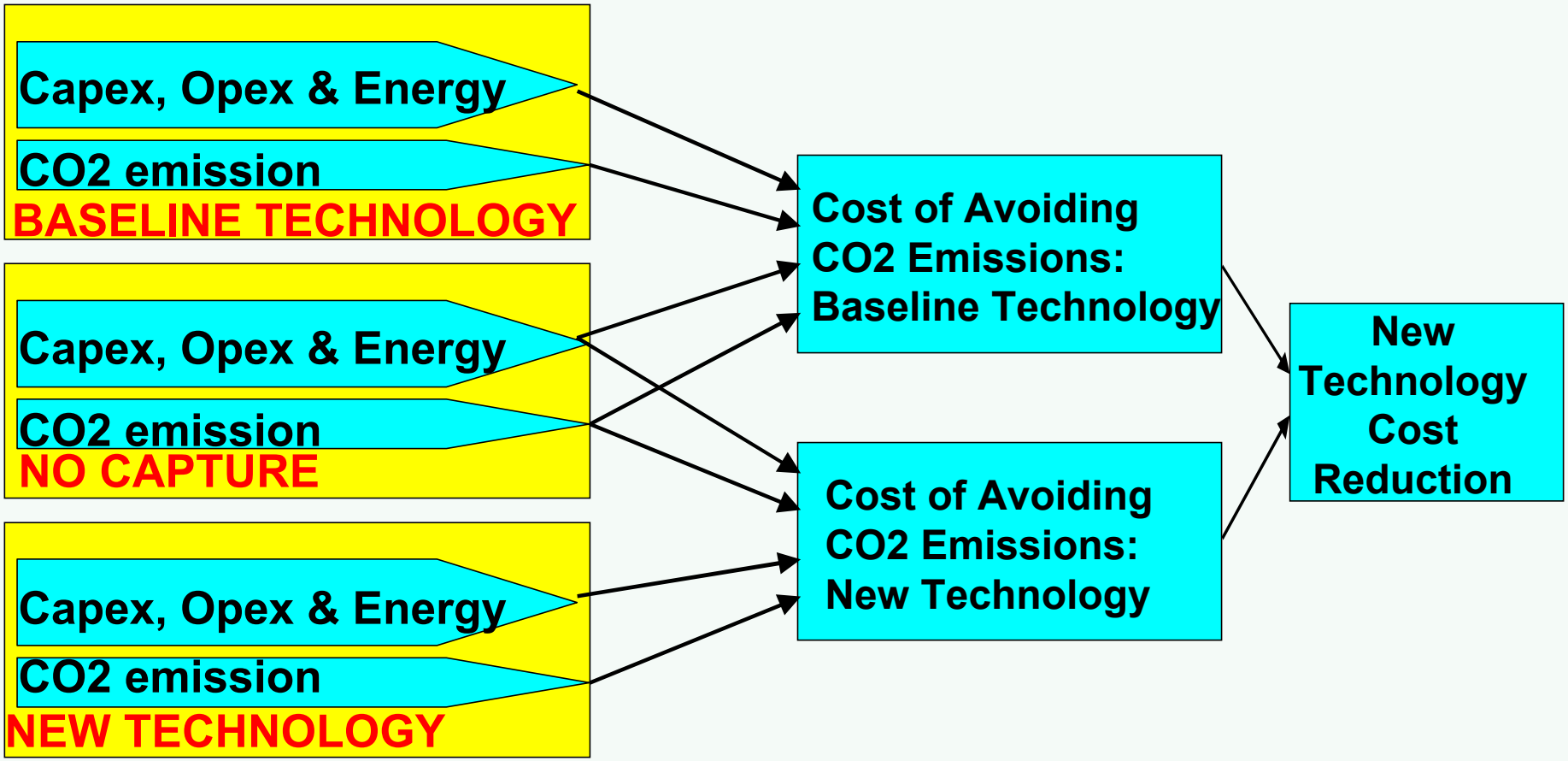
- Post Combustion
  a. Solvent-based CO_2 removal from flue gas
  b. Several Vendors: Chose Econamine FG^{SM} Process

- Pre Combustion
  a. Physical solvent which can selectively remove H_2S and CO_2 from high pressure syngas streams
  b. Several Vendors: Chose Selexol

Cost Estimation: Jargon

- CO2 Captured
  - Total capture-related cost (capex, O&M, energy) per tonne CO2 captured **(direct)**
- CO2 Avoided (different for retrofit cases)
  - Direct capture costs (above), minus CO2-content of energy "imports" **(indirect)**
- Normalized assuming US Gulf Coast location costs
- All CO2 costs calculated as normalized differentials between capture vs. non-capture cases
- Aim is to minimize the cost of CO2 avoided

Cost Reduction Calculation

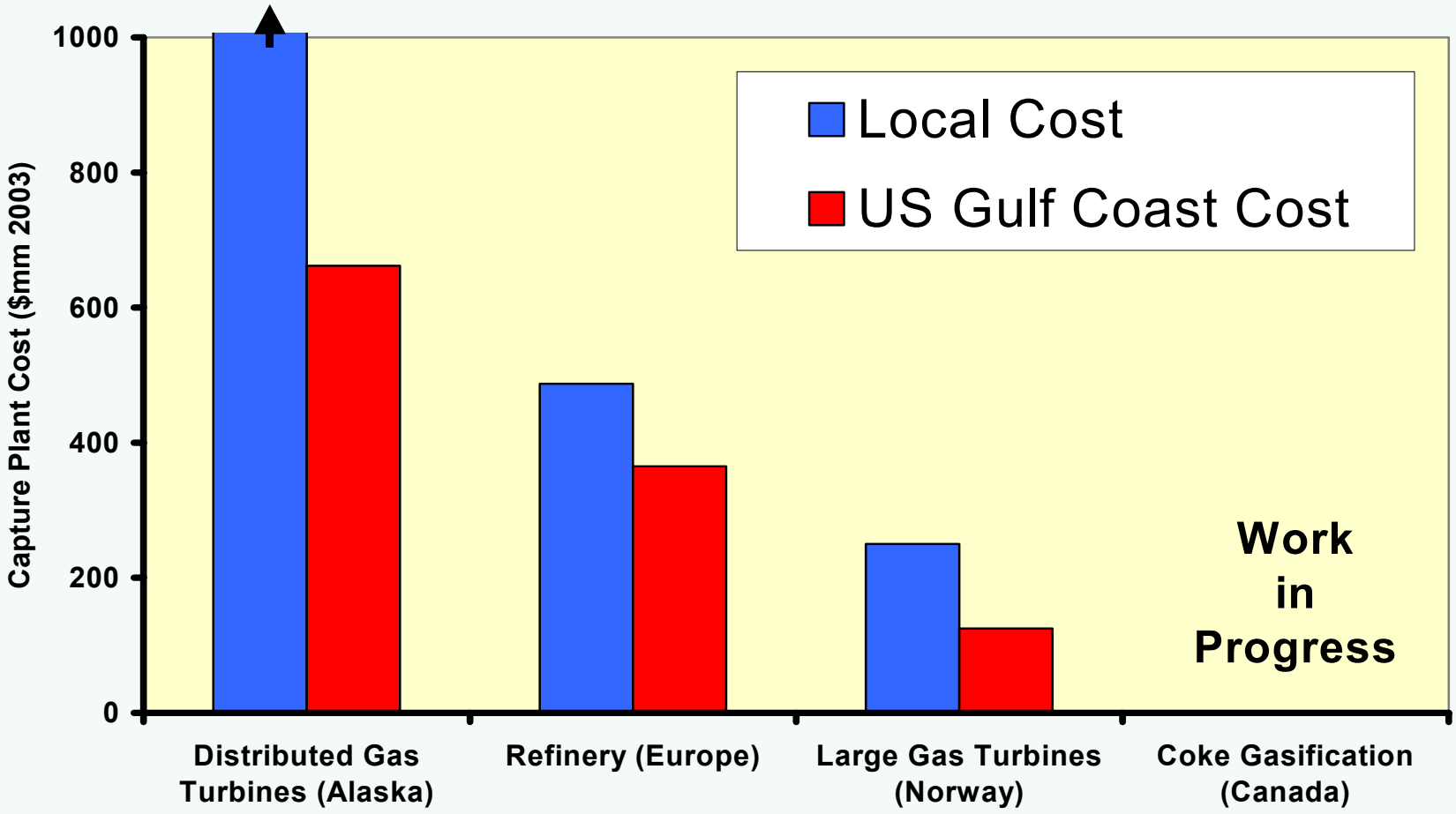


How much CO2 ?

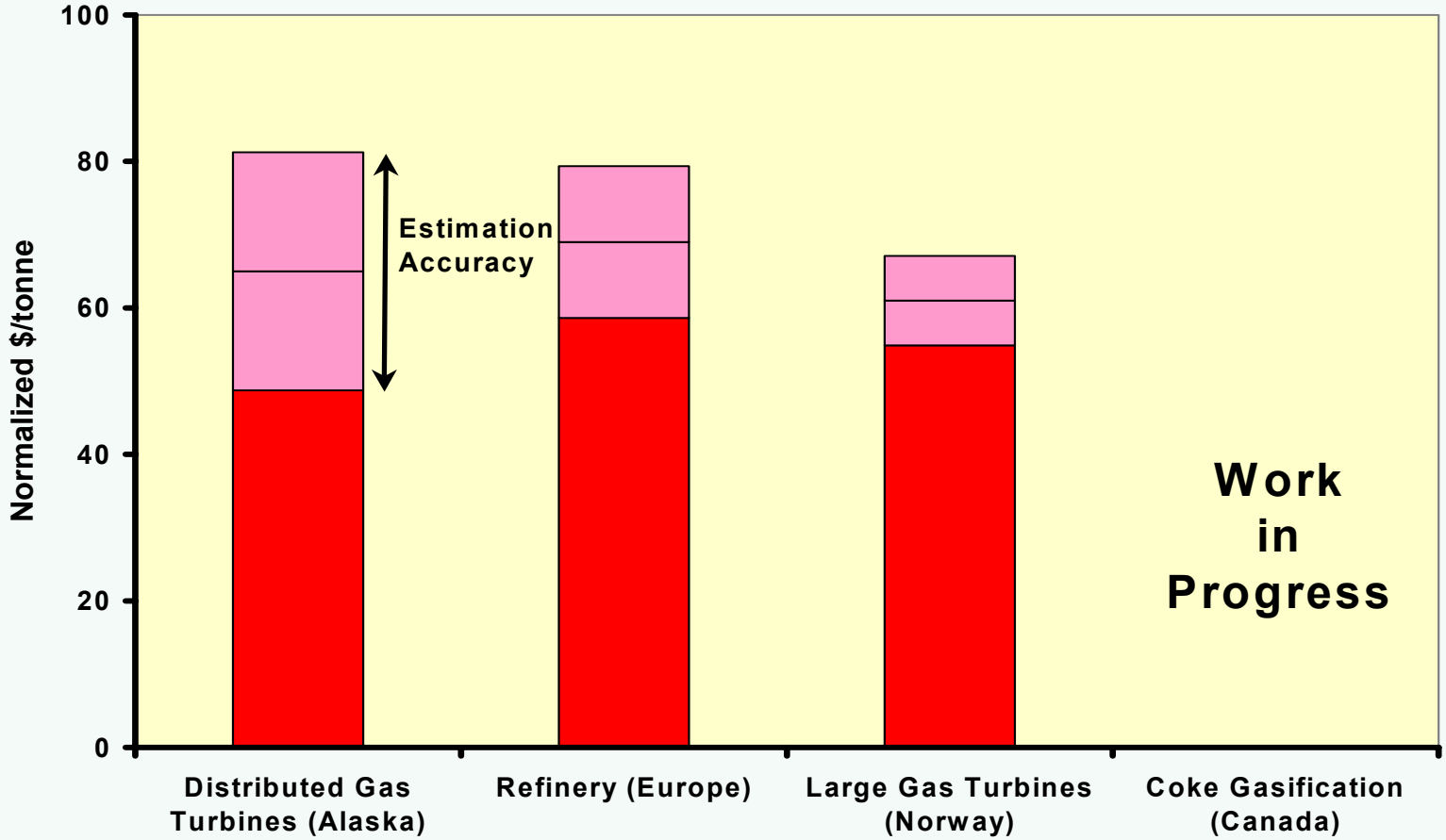
Scenario	Location	Capture Technology	CO2 Uncontrol (mmtpa CO2)	CO2 Captured (mmtpa CO2)	CO2 Avoided (mmtpa CO2)
Distributed Gas Turbines	Alaska USA	EconAmine (Post-Combust)	2.1	1.9	2.0*
Refinery	UK Europe	EconAmine (Post-Combust)	4.0	2.2	1.5
Large Gas Turbines	Norway	EconAmine (Post-Combust)	1.2	1.0	0.9
Coke Gasification	Canada	Selexol (Pre-Combust)	7.4	6.8	6.8

* Additional power is available

Normalization: Location Factor



Normalized Baseline Costs: CO2 Avoided



CCP Way Forward (Capture Technology)

- Thru October 2003
  a. Capture Technology Development
- June 2003
  a. Choose best new technologies for each scenario
- July – October 2003
  a. Design & Costing for best new technology for each Scenario
- December 2003: Publish Results
  a. www.co2captureproject.org
- March 2004
  ✓ Final Stakeholder Workshops: Capture & Storage